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PC 10568

Pressure Sensor Module

Technical Field

The present invention relates to a pressure sensor module for electronic brake systems in motor vehicles.

WO 01/85511 A1 discloses integrating pressure sensors into electronic brake control devices. The embodiments described in the mentioned publication relate to the integration of single sensors, which are fastened directly into a hydraulic unit by means of clinched engagement.

Generic EP 1068120 B1 discloses a pressure sensor module having pressure sensors, which are fastened in the sensor housing by way of sealing rings or holding rings in a sophisticated manner. In addition, the arrangement and the sophisticated fabrication of several boreholes or threaded holes in the sensor housing and hydraulic housing is required to interconnect both housings by several screws. Leakage can occur and the screws can loosen when the tightening moment of the screws falls below the necessary tightening moment.

In view of the above, an object of the invention is to provide a pressure sensor module that is most simple to manufacture and does not exhibit the above-mentioned drawbacks.

~~This object is achieved for a pressure sensor module of the type mentioned hereinabove by the characterizing features of patent claim 1.~~

~~Further advantages, features and possible applications of the invention can be taken from the sub claims and the following description of several embodiments by way of the accompanying drawings.~~

~~In the drawings,~~

Brief Description of The Drawings

Figure 1 is a view of a cross-section taken through a cylindrical element that is directed into a section of a sensor housing and into a section of a hydraulic housing, said housings being connected to the element exclusively by means of a housing deformation produced by self-calking.

Figure 2 is an alternative embodiment of the element shown in Figure 1, with an attachment combination consisting of self-calking in the hydraulic housing and a press fit engagement of the element in the sensor housing.

Figure 3 shows, different from Figures 1 and 2, an attachment combination consisting of a screw coupling of the element with the sensor housing and a self-calking attachment of the element with the hydraulic housing.

Figure 4 shows different from Figure 1 a weld joint of the element and a cap-shaped upper part.

Figure 5 is a total view of the sensor housing with several elements attached therein by means of self-calking, with only the elements arranged at the ends of the sensor housing being connected to the hydraulic housing by means of self-calking.

Figure 6 shows, based on Figure 5, a functional variation of the elements arranged at the ends of the sensor housing, said elements fulfilling a flow function in addition to an attachment function.

Detailed Description of The Preferred Embodiments

Figures 1 to 6 present a pressure sensor module for use in electrohydraulic brake systems in particular. As is known, a pressure sensor module accommodates several pressure sensors arranged in a sensor housing 13, which is attached with its flange surface to the mounting surface of a hydraulic housing 12 in such a fashion that several pressure ducts 14 arranged in the sensor housing 13 and in the hydraulic housing 12 are interconnected for pressure detection.

According to the invention, a cylindrical element 3 provided with two fastening sections 1, 2 is arranged between the flange surface 4 and the mounting surface 5, said element extending from there with its diametrical fastening sections 1, 2 into the sensor and hydraulic housings 13, 12. As becomes apparent from Figures 1 to 6, a first accommodating bore 6 opens in each case into the flange surface 4 of the sensor housing 13, and the first fastening section 1 of the cylindrical element 3 extends into said accommodating bore in operative and/or positive engagement.

Further, it can be taken from Figures 1 to 6 that a second accommodating bore 7 opens into the mounting surface 5 of the hydraulic housing 12 and houses the second fastening section 2 of the cylindrical element 3 in operative and/or positive engagement. Arranged between the two fastening sections 1, 2 of the cylindrical element 3 is a bead 8 with two annular surfaces, and its annular surface close to the sensor housing 13 abuts on an edge of the first accommodating bore 6, while its second annular surface close to the hydraulic housing 12 abuts on an edge of the second accommodating bore 7. Both accommodating bores 6, 7 are coaxially aligned relative to each other, and one of the two accommodating bores 6, 7 includes a recess 9 into which the bead 8 plunges completely. The circular recess 9 is indented into the flange surface of the sensor housing 12 in the examples according to Figures 1 to 6.

Element 3 having a cylindrical structure includes at least one waist 10 of a great material hardness on the periphery of at least one of the two fastening sections 1, 2, into which waist either the material of the sensor housing 13 that is softer compared to the waist 10 or the material of the hydraulic housing 12 that is softer compared to the waist 10 is displaced for sealing and fastening purposes, depending on the depth of immersion of the element 3 into at least one of the two accommodating bores 6, 7. To this end, at least the fastening sections 1, 2 of element 3 provided with the waist 10 are made of steel, preferably of free-cutting steel, or brass. In comparison thereto, the sensor housing 13 and/or the hydraulic housing 12 is made of light metal, preferably of an aluminum wrought alloy. An extruded profile is especially appropriate for this purpose.

In Figure 6 the cylindrical element 3 is favorably designed as a pressure pipe for conducting the pressure prevailing in the hydraulic housing 12 in the direction of the sensor housing 13 so that the element 3 fulfils not only a fastening function but also a flow function.

In addition, the invention arranges for the cylindrical element 3 to carry a measuring element 11 for detecting the pressure in the hydraulic housing 12, to what effect the cylindrical element 3 is configured as a meter tube, with the measuring element 11 being fastened to the meter tube end arranged in the sensor housing 13.

In addition to the common features explained in Figures 1 to 6, the special characteristics of each embodiment shown will be referred to briefly in the following.

Figure 1 shows as a special feature the attachment of the element 3 in the hydraulic and sensor housings 12, 13 exclusively produced by self-calking at the two fastening sections 1, 2, to what end first of all the first fastening section 1 is press fitted into the stepped accommodating bore 6, so that the material of the sensor housing 13 that is softer compared to the element 3 is displaced into the waist or compressed, respectively, what is done by means of a step 15 adjacent to the waist 10. Thus, the element 3 quasi performs the function of a calking punch whose advance movement is produced by an axial force that is effective at bead 8. After the desired elements 3 have been fastened in the sensor housing 13, the sensor housing 13 is aligned with respect to the pressure ducts 14 in the hydraulic housing 12 and press fitted, with a defined force, by means of the second fastening sections 2 into the pressure ducts 14 for providing self-calking (self-clinch).

Other than the object according to Figure 1, the first tubular fastening section 1 is provided with a press fit in the embodiment according to Figure 2 so that there is no need to arrange a waist 10 in the area of the first fastening section 1. Therefore, the first fastening section 1 is so fabricated that it is only slightly oversized with regard to the first accommodating bore 6. The press fit chosen is advantageous inasmuch as the sensor housing 13 can also be manufactured from steel, if desired or required. The second fastening section 2 is connected by way of self-calking, as has been described already with respect to Figure 1.

Different from the previous embodiments, a thread 16 is used in Figure 3 to connect the first fastening section 1 to the sensor housing 13. The element 3 is sealed in the sensor housing 13

by means of a sealing cone 17 at the first fastening section 1 which will abut on a conical sealing seat above the thread 16 after the element 3 has been screwed into the first accommodating bore 6. Similar to the previous examples, the second fastening section 2 is undetachably connected to the hydraulic housing 12 by means of self-calking, preventing also the thread 16 from detaching.

Based on an attachment of the element 3 in the hydraulic and sensor housing 12, 13 according to Figure 1, Figure 4 shows that a cap-shaped upper part 18 is welded at the first fastening section 1 for the accommodation of a measuring element 11. This is advantageous because different materials can be employed as desired or required.

Figure 5 is a cross-sectional side view of a block-shaped sensor housing 13, having several parallel tubular members attached by means of self-calking, with only the tubular members arranged at the two ends of the sensor housing 13 in their capacity of the initially mentioned elements 3 being connected to the hydraulic housing 12 by means of self-calking. Corresponding to their design according to Figure 4, said elements 3 can accommodate measuring elements 11 also at their upper parts. Between the two elements 3, the tubular members arranged in the further accommodating bores 6 of the sensor housing 13 are only configured as calked measuring element carriers 19 which do not exhibit any mechanical connection to the hydraulic housing 12. Said measuring element carriers 19 are in connection to the pressure ducts 14 of the hydraulic housing 12 by way of pressure measuring bores 20 in the flange surface 4. The flange surface 4 is sealed relative to the mounting surface 5 in the area of the pressure measuring bores 20 either by way of single seals 21 or a sealing plate 22.

Different from the design of Figure 5, the two outward elements 3 in Figure 6 are only used as fastening elements calked into the sensor housing and hydraulic housing 12, 13 and being connected by way of transverse channels 23 to two tubular members calked into the sensor housing 13, said tubular members corresponding to the measuring element carriers 19 known from Figure 5. Disposed between these two measuring element carriers 19 are further measuring element carriers 19 that correspond in their design and function to those explained with respect to Figure 5. In the area of the two outward elements 3 the sensor housing 13 has a broad abutment surface being used to accommodate the necessary press-in force in order to calk the two outward elements 3 with the hydraulic housing 12. The broad abutment surface 24 is limited laterally by a housing frame 25 in which the measuring element carriers 19 and,

as the case may be, also components or the entire necessary pressure sensor electronics is disposed. A housing cover (not shown) closes the housing frame 25.

The invention disclosed allows providing a pressure sensor module, which is particularly simple to fasten at a hydraulic housing and whose elements 3 suggested for the attachment are configured in such a manner that the elements 3 can fulfill additional functions such as the propagation of pressure into the sensor housing 13, and the accommodation of the measuring elements 11 required for the pressure detection, or a sealing function.

~~List of Reference Numerals:~~

~~1 fastening section~~
~~2 fastening section~~
~~3 element~~
~~4 flange surface~~
~~5 mounting surface~~
~~6 accommodating bore~~
~~7 accommodating bore~~
~~8 bead~~
~~9 recess~~
~~10 waist~~
~~11 measuring element~~
~~12 hydraulic unit~~
~~13 sensor housing~~
~~14 pressure duct~~
~~15 step~~
~~16 thread~~
~~17 sealing cone~~
~~18 upper part~~
~~19 measuring element carrier~~
~~20 pressure measuring bore~~
~~21 single seal~~
~~22 sealing plate~~
~~23 transverse channel~~
~~24 abutment surface~~
~~25 frame~~

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